Avoiding plagiarism, self-plagiarism, and other questionable writing practices: A guide to ethical writing

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In recognizing the importance of educating aspiring scientists in the responsible conduct of research (RCR), the Office of Research Integrity (ORI), began sponsoring in 2002 the creation of instructional resources to address this pressing need. The present guide on avoiding plagiarism and other inappropriate writing practices was created, in part, to meet this need. Its purpose is to help students, as well as professionals, identify and prevent such practices and to develop an awareness of ethical writing. This guide is one of the many products stemming from ORI's educational initiatives in the RCR.

INTRODUCTION

Scientific writing can be a complex and arduous process, for it simultaneously demands clarity and conciseness; two elements that often clash with each other. In addition, accuracy and integrity are fundamental components of the scientific enterprise and, therefore, of scientific writing. Thus, good scientific writing must be characterized by clear expression, conciseness, accuracy of what is being reported, and perhaps most importantly, honesty. Unfortunately, writing, or for that matter the entire scientific process, often occurs within the constraints of tight deadlines and other competing pressures. As a result of these constraints, scientific papers, whether generated by science students or by seasoned professionals, will at times be deficient in one or more of the above components.

Insufficient clarity or lack of conciseness is typically unintentional and relatively easy to remedy by standard educational or editorial steps. Lapses in the accuracy of what is reported (e.g., faulty observations, incorrect interpretation of results) are also assumed to be most often unintentional in nature, but such lapses, even if unintentional, can have significant undesirable consequences if not corrected. Intentional lapses in integrity, even if seemingly minor, are by far the most serious type of problem because such misconduct runs contrary to the primary goal of the scientific enterprise, which is the search for truth.

In scientific writing, perhaps the most widely recognized unethical lapse is plagiarism. Plagiarism can occur in many forms and some of the more subtle instances, while arguably unethical in nature, may not be classified as scientific misconduct by federal agencies such as the National Science Foundation (NSF) or the Office of Research Integrity (ORI). Nevertheless, the ethical professional is expected to operate at the highest levels of scientific integrity and, therefore, must avoid all forms of writing that could be conceptualized as plagiarism.

There are other questionable writing practices, some of which may be quite common in professional scientific writing. One example is reporting and discussing results of one's research in the context of literature that is supportive of our conclusions while at

the same time ignoring evidence that is contrary to our findings. Another writing 'malpractice' occurs when another author's review of a literature is used, yet the reader is led to believe that the current author has conducted the actual review.

On ethical writing

A general principle underlying ethical writing is the notion that the written work of an author, be it a manuscript for a magazine or scientific journal, a research paper submitted for a course, or a grant proposal submitted to a funding agency, represents an implicit contract between the author of that work and its readers. According to this implicit contract, the reader assumes that the author is the sole originator of the written work, that any text or ideas borrowed from others are clearly identified as such by established scholarly conventions, and that the ideas conveyed therein are accurately represented to the best of the author's abilities. In sum, as Kolin (2002) points out, "Ethical writing is clear, accurate, fair, and honest". It also conveys to the reader that we strive for ethical conduct as well as ethical practice.

As is the case with most other human activities, errors in writing which violate the spirit of the contract do occur. For example, in proposing a new idea or data, an author may dismiss a certain line of evidence as unimportant, and thus quite unintentionally, ignore other established data or other evidence that fail to support, or outright contradict, his/her own ideas or data thereby misleading the reader. Judging by some of the readers' letters and commentaries published in scientific journals in response to certain published articles, this type of oversight appears to be not all that uncommon in the sciences, particularly when dealing with controversial topics.

Other errors include situations in which an idea claimed by its author to be completely original, may have actually been articulated earlier by someone else. Such "rediscovery" of ideas is a relatively well-known phenomenon in the sciences, often occurring within a very close timeframe. Cognitive psychologists have provided considerable evidence for the existence of cryptomnesia, or unconscious plagiarism, which refers to the notion that individuals previously exposed to others' ideas will often remember the idea, but not its source, and mistakenly believe that they themselves originated the idea.

Other unintentional errors occur, such as when authors borrow heavily from a source and, in careless oversight, fail to fully credit the source. These and other types of inadvertent lapses are thought to occur with some frequency in the sciences. Unfortunately, in some cases, such lapses are thought to be intentional and therefore constitute clear instances of unethical writing. Without a doubt, plagiarism is the most widely recognized and one of the most serious violations of the contract between the reader and the writer. Moreover, plagiarism is one of the three major types of scientific misconduct as defined by the Public Health Service; the other two being falsification and fabrication (U. S. Public Health Service, 1989). Most often, those found to have committed plagiarism pay a steep price. Plagiarists have been demoted, dismissed from

their schools, from their jobs, and their degrees and honors have been rescinded as a result of their misdeeds (Standler, 2000).

PLAGIARISM

> "taking over the ideas, methods, or written words of another, without acknowledgment and with the intention that they be taken as the work of the deceiver." American Association of University Professors (September/October, 1989).

As the above quotation states, plagiarism has been traditionally defined as the taking of words, images, ideas, etc. from an author and presenting them as one's own. It is often associated with phrases, such as kidnapping of words, kidnapping of ideas, fraud, and literary theft. Plagiarism can manifest itself in a variety of ways and it is not just confined to student papers or published articles or books. For example, consider a scientist who makes a presentation at a conference and discusses at length an idea or concept that had already been proposed by someone else and that is not considered common knowledge. During his presentation, he fails to fully acknowledge the specific source of the idea and, consequently, misleads the audience into thinking that he was the originator of that idea. This, too, may constitute an instance of plagiarism. Consider the following real-life examples of plagiarism and the consequences of the offender's actions:

- A historian resigns from the Pulitzer board after allegations that she had appropriated text from other sources in one of her books.
- A biochemist resigns from a prestigious clinic after accusations that a book he wrote contained appropriated portions of text from a National Academy of Sciences report.
- A famous musician is found guilty of unconscious plagiarism by including elements of another musical group's previously recorded song in one of his new songs that then becomes a hit. The musician is forced to pay compensation for the infraction.
- A college president is forced to resign after allegations that he failed to attribute the source of material that was part of a college convocation speech.
- A member of Congress running for his party's nomination withdraws from the presidential race after allegations of plagiarism in one of his speeches.
- A psychologist has his doctoral degree rescinded after the university finds that portions of his doctoral dissertation had been plagiarized.

In sum, plagiarism can be a very serious form of ethical misconduct. For this reason, the concept of plagiarism is universally addressed in all scholarly, artistic, and scientific disciplines. In the humanities and the sciences, for example, there are a plethora of writing guides for students and professionals whose purpose, in part, is to provide guidance to authors on discipline-specific procedures for acknowledging the contributions of others. Curiously, when it comes to the topic of plagiarism, many professional writing guides appear to assume that the user is already familiar with the concept. In fact, while

instruction on attribution, a key concept in avoiding plagiarism, is almost always provided, some of the most widely used writing guides do not offer specific sections on plagiarism. Moreover, those that provide coverage often fail to go beyond the most basic generalities about this type of transgression.

Although plagiarism can take many forms there are two major types in scholarly writing: plagiarism of ideas and plagiarism of text.

Plagiarism of ideas

- *Appropriating an idea (e.g., an explanation, a theory, a conclusion, a hypothesis, a metaphor) in whole or in part, or with superficial modifications without giving credit to its originator.*

In the sciences, as in most other scholarly endeavors, ethical writing demands that ideas, data, and conclusions that are borrowed from others and used as the foundation of one's own contributions to the literature, must be properly acknowledged. The specific manner in which we make such acknowledgement varies from discipline to discipline. However, source attribution typically takes the form of either a footnote or a reference citation.

Acknowledging the source of our ideas

Just about every scholarly or scientific paper contains several footnotes or reference notes documenting the source of the facts, ideas, or evidence that is reported in support of arguments or hypotheses. In some cases, as in those papers that review the literature in a specific area of research, the reference section listing the sources consulted can be quite extensive, sometimes taking up more than a third of the published article (see, for example, Logan, Walker, Cole, & Leukefeld, 2000). Most often, the contributions we rely upon come from the published work or personal observations of other scientists or scholars. On occasion, however, we may derive an important insight about a phenomenon or process that we are studying, through a casual interaction with an individual not necessarily connected with scholarly or scientific work. Even in such cases, we still have a moral obligation to credit the source of our ideas. A good illustrative example of the latter point was reported by Alan Gilchrist in a 1979 Scientific American article on color perception. In a section of the article which describes the perception of rooms uniformly painted in one color, Gilchrist states: "We now have a promising lead to how the visual system determines the shade of gray in these rooms, although we do not yet have a complete explanation. (John Robinson helped me develop this lead.)" (p.122; Gilchrist, 1979). A reader of the scientific literature might assume that Mr. Robinson is another scientist working in the field of visual perception, or perhaps an academic colleague or an advanced graduate student of Gilchrist's. The fact is that John Robinson was a local plumber and an acquaintance of Gilchrist in the town where the author spent his summers. During a casual discussion of Gilchrist's work, Robinson's insights into the problem that Gilchrist had been working on were sufficiently important to the development of his theory of lightness

perception that Gilchrist felt ethically obligated to credit Robinson's contribution.

Even the most ethical authors can fall prey to the inadvertent appropriation of others' ideas, concepts, or metaphors. Here we are referring to the phenomenon of unconscious plagiarism, which, as stated earlier, takes place when an author generates an idea that s/he believes to be original, but which in reality had been encountered at an earlier time. Given the free and frequent exchange of ideas in science, it is not unreasonable to expect instances in which earlier exposure to an idea that lies dormant in someone's unconscious, emerges into consciousness at a later point, but in a context different from the one in which the idea had originally occurred. Presumably, this is exactly what happened in the case of former Beatle George Harrison, whose song "My Sweet Lord" was found to have musical elements of the song "He's So Fine", which had been released years earlier by The Chiffons (see Bright Tunes Music Corp. v. Harrisongs Music, Ltd., 1976). Unfortunately, there are probably other John Robinsons, as well as other accomplished scientists, scholars, and artists, now forgotten, whose original, but unacknowledged ideas have been subsequently and unconsciously (or sadly, perhaps quite intentionally) "reinvented/rediscovered" by others and have, thus, failed to get their due credit.

In some cases the misappropriation of an idea can be a subtle process. Consider the famous case of Albert Schatz who, as a graduate student working under Selman Waksman at Rutgers, discovered the antibiotic streptomycin. Even though the first publications describing his discovery identified Schatz as primary author (Martin, 1997), it was Wakman who, over a period of time, began to take sole credit for the discovery ultimately earning him the Nobel prize in 1952 (see, for example, Shatz, 1993; Mistiaen, 2002 for a fuller description of this case).

Of course, there also have been instances in which unscrupulous scientists have intentionally misappropriated ideas. The confidential peer review process is a ripe source from which ideas may be plagiarized. Consider the scenario where the offender is a journal or conference referee, or a member of a review panel for a funding agency. He reads a paper or a grant proposal describing a promising new methodology in an area of research directly related to his own work. The grant fails to get funded based, in large part, on his negative evaluation of the protocol. He then goes back to his lab and prepares a grant proposal using the methodology stolen from the proposal that he refereed earlier and submits his proposal to a different granting agency.

Most of us would deem the behavior depicted in the above scenario as downright despicable. Unfortunately, similar situations have occurred. In fact, elements of the above scenario are based on actual cases of scientific misconduct investigated by ORI. The peer review context appears to be sufficiently susceptible to the appropriation of ideas that in 1999 the federal Office of Science and Technology expanded their definition of plagiarism as follows:

> "Plagiarism is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit, including those obtained

through confidential review of others' research proposals and manuscripts." (Office of Science and Technology Policy, 1999).

Guideline 1: An ethical writer ALWAYS acknowledges the contributions of others and the source of his/her ideas.

Plagiarism of text

- *Copying a portion of text from another source without giving credit to its author and without enclosing the borrowed text in quotation marks.*

When it comes to using others' word-for-word (verbatim) text in our writing the universally accepted rule is to enclose that information in quotations and to indicate the specific source of that text. When quoting text from other sources, you must provide a reference citation and the page number indicating where the text comes from. Although the use of direct quotes is uncommon in the biomedical literature, there may be occasions when it is warranted. The material quoted earlier from Gilchrist (1979) serves as a good example of when to use quotations.

Although the evidence indicates that most authors, including college students, are aware of rules regarding the use of quotation marks, plagiarism of text is probably the most common type of plagiarism. However, plagiarism of text can occur in a variety of forms. The following review will allow the reader to become familiar with the various subtle forms of plagiarism of text.

Guideline 2: Any verbatim text taken from another author must be enclosed in quotation marks.

Let's consider the following variety:

- *Copying a portion of text from one or more sources, inserting and/or deleting some of the words, or substituting some words with synonyms, but never giving credit to its author nor enclosing the verbatim material in quotation marks.*

The above form of plagiarism is relatively well known and has been given names, such as patchwriting (Howard, 1999) and paraphragiarism (Levin & Marshall, 1993). Iverson, et al. (1998) in the American Medical Association's Manual of Style identify this type of unethical writing practice as mosaic plagiarism and they define it as follows:

> "Mosaic: Borrowing the ideas and opinions from an original source and a few verbatim words or phrases without crediting the original author. In this case, the plagiarist intertwines his or her own ideas and opinions with those of the original author, creating a 'confused

plagiarized mass'" (p. 104).

Another, more blatant form which may also constitute plagiarism of ideas occurs when an author takes a portion of text from another source, thoroughly paraphrases it, but never gives credit to its author.

Guideline 3: We must always acknowledge every source that we use in our writing; whether we paraphrase it, summarize it, or enclose it quotations.

Inappropriate paraphrasing

- *Taking portions of text from one or more sources, crediting the author/s, but only changing one or two words or simply rearranging the order, voice (i.e., active vs. passive) and/or tense of the sentences.*

Inappropriate paraphrasing is perhaps the most common form of plagiarism and, at the same time, the most controversial. This is because the criteria for what constitutes proper paraphrasing differs between individuals even within members of the same discipline. We will discuss these issues shortly, but first let's consider the process of paraphrasing.

Paraphrasing and Summarizing

Scholarly writing, including scientific writing, often involves the **paraphrasing** and **summarizing** of others' work. For example, in the introduction of a traditional scientific paper it is customary to provide a brief and concise review of the pertinent literature. Such a review is accomplished by the cogent synthesis of relevant theoretical and empirical studies and the task typically calls for the summarizing of large amounts of information.

Guideline 4: When we summarize, we condense, in our own words, a substantial amount of material into a short paragraph or perhaps even into a sentence.

At other times, and for a variety of reasons, we may wish to restate in detail and in our own words a certain portion of another author's writing. In this case, we must rely on the process of paraphrasing. Unlike a summary, which results in a substantially shorter textual product, a paraphrase usually results in writing of equivalent textual length as the original, but, of course, with a different words and, ideally, different sentence structure. Whether paraphrasing or summarizing others' work, we must always provide proper credit. In fact, when paraphrasing in the humanities, one may thoroughly modify another author's text and provide the proper citation. However, if the original sentence structure is preserved in the paraphrase, some will classify such writing as an instance of plagiarism.

Guideline 5: Whether we are paraphrasing or summarizing we must always identify the source of our information.

Paraphrasing and Plagiarism: What the writing guides say

Although virtually all professional and student writing guides, including those in the sciences, provide specific instructions on the proper use of quotes, references, etc., many fail to offer specific details on proper paraphrasing. With some exceptions, writing guides that provide instructions for proper paraphrasing and avoiding plagiarism tend to subscribe to a 'conservative' approach to paraphrasing. That is, these guides often suggest that when paraphrasing, an author must substantially modify the original material. Consider the following examples of paraphrasing guidelines:

> "**Don't plagiarize**. Express your own thoughts in your own words…. Note, too, that simply changing a few words here and there, or changing the order of a few words in a sentence or paragraph, is still plagiarism. Plagiarism is one of the most serious crimes in academia." (Pechenik, 2001; p.10).

> "You plagiarize even when you do credit the author but use his exact words without so indicating with quotation marks or block indentation. You also plagiarize when you use words so close to those in your source, that if your work were placed next to the source, it would be obvious that you could not have written what you did without the source at your elbow." (Booth, Colomb, & Williams, 1995; p. 167)

On the other hand, some writing guides appear to suggest a more liberal approach to paraphrasing. For example, consider the following guideline from the Publication Manual of the American Psychological Association (2001), a guide that is also used by other disciplines (e.g., Sociology, Education), in addition to psychology:

> "…*Each time* you paraphrase another author (i.e., summarize a passage or rearrange the order of a sentence and change some of the words), you need to credit the source in the text." (p. 349).

However, this same resource provides an example of paraphrasing that is consistent with the more conservative definitions outlined above. Moreover, other writing guides (e.g., Hacker, 2000) that review the style used by American Psychological Association (APA) interpret the APA guidelines in the same conservative fashion. I advocate the more conservative approach to paraphrasing with one caveat (see below).

Guideline 6: When paraphrasing and/or summarizing others' work we must reproduce the exact meaning of the other author's ideas or facts using our words and sentence structure.

Examples of paraphrasing: Good and Bad

The ethical writer takes great care to insure that any paraphrased text is sufficiently modified so as to be judged as new writing. Let's consider various paraphrased versions of the following material on the electrochemical properties of neurons (taken from Martini & Bartholomew, 1997). In acknowledging the source, we will use the footnote method commonly used in the biomedical sciences. The actual reference would appear in the reference section of the paper.

> **"Because the intracellular concentration of potassium ions is relatively high, potassium ions tend to diffuse out of the cell. This movement is driven by the concentration gradient for potassium ions. Similarly, the concentration gradient for sodium ions tends to promote their movement into the cell. However, the cell membrane is significantly more permeable to potassium ions than to sodium ions. As a result, potassium ions diffuse out of the cell faster than sodium ions enter the cytoplasm. The cell therefore experiences a net loss of positive charges, and as a result the interior of the cell membrane contains an excess of negative charges, primarily from negatively charged proteins."[1] (p. 204).**

Here is an Appropriate Paraphrase of the above material:

> A textbook of anatomy and physiology[1] reports that the concentration of potassium ions inside of the cell is relatively high and, consequently, some potassium tends to escape out of the cell. Just the opposite occurs with sodium ions. Their concentration outside of the cell causes sodium ions to cross the membrane into the cell, but they do so at a slower rate. According to these authors, this is because the permeability of the cell membrane is such that it favors the movement of potassium relative to sodium ions. Because the rate of crossing for potassium ions that exit the cell is higher than that for sodium ions that enter the cell, the inside portion of the cell is left with an overload of negatively charged particles, namely, proteins that contain a negative charge.

Notice that, in addition to thoroughly changing much of the language and some of the structure of the original paragraph, the paraphrase also indicates, as per guideline 5, that the ideas contained in the rewritten version were taken from another source. When we

paraphrase and/or summarize others' work we must also give them due credit, a rule not always applied by inexperienced writers.

Let's suppose that instead of paraphrasing, we decide to summarize the above paragraph from Martini and Bartholomew. Here is one summarized version of that paragraph:

> The interior of a cell maintains a negative charge because more potassium ions exit the cell relative to sodium ions that enter it, leaving an over abundance of negatively charged protein inside of the cell.[1]

In their attempts at paraphrasing, sometimes authors commit 'near plagiarism' (or plagiarism, depending on who is doing the judging) because they fail to sufficiently modify the original text and thus, produce an inappropriately paraphrased version. Depending on the extent of modifications to the original, the extent of text involved, and on who is doing the judging, inappropriate paraphrasing may constitute an instance of plagiarism. For example, the following versions of the Martini and Bartholomew paragraph are inappropriately paraphrased and can thus be classified as plagiarized versions:

Inappropriate paraphrase (version 1):

> Because the intracellular concentration of potassium ions is _ high, potassium ions tend to diffuse out of the cell. This movement is triggered by the concentration gradient for potassium ions. Similarly, the concentration gradient for sodium ions tends to promote their movement into the cell. However, the cell membrane is much more permeable to potassium ions than to it is to sodium ions. As a result, potassium ions diffuse out of the cell more rapidly than sodium ions enter the cytoplasm. The cell therefore experiences a _ loss of positive charges, and as a result the interior of the cell membrane contains a surplus of negative charges, primarily from negatively charged proteins.[1] (p. 204).

A comparison between the original version of the Martini and Bartholomew paragraph to the 'rewritten' version above reveals that the rewritten version is a mere copy of the original. The few modifications that were made are superficial, consisting merely of a couple of word deletions, substitutions, and additions. Even though by the insertion of a reference note ([1]) the writer has credited Martini and Bartholomew with the ideas expressed, most of the words and structure of the original paragraph are preserved in the rewritten version. Therefore, the reader would have been misled as to the origin of the writing.

Inappropriate paraphrase (version 2):

> The concentration gradient for sodium (Na) ions tends to promote their movement into the cell. Similarly, the high intracellular concentration of potassium (K) ions is relatively high <u>resulting</u> in K's tendency to diffuse out of the cell. Because the cell membrane is significantly more permeable to K than to Na, K diffuses out of the cell faster than Na enter the cytoplasm. The cell therefore experiences a net loss of positive charges and, as a result the interior of the cell membrane <u>now</u> <u>has</u> an excess of negative charges, primarily from negatively charged proteins.[1] (p. 204).

At first glance this second 'rewritten' version may look as if it has been significantly modified from the original, but in reality, it is not unlike the first inappropriately paraphrased version in that only superficial changes have been made to the original. In this particular case, the writer has made a seemingly disingenuous change by substituting the names of the atoms by using their chemical symbols (e.g., sodium = Na). In addition, the order of the first two sentences was changed giving the appearance of a substantial modification. However, as in the previous version, the language and much of the rest of structure is still too similar to the original.

Again, it must be emphasized that when we paraphrase we must make every effort to restate the ideas in our words. Here is another properly paraphrased version:

<u>Appropriate paraphrase (version 2):</u>

> **The relatively high concentration gradient of sodium ions outside of the cell causes them to enter into the cell's cytoplasm. In a similar fashion, the interior concentration gradient of potassium ions is also high and, therefore, potassium ions tend to scatter out of the cell through the cell's membrane. But, a notable feature of this process is that Potassium ions tend to leave the cell faster than sodium ions enter the cytoplasm. This is because of the nature of the cell membrane's permeability, which allows potassium ions to cross much more freely than sodium ions. The end result is that the interior of the cell membrane's loss of positive charges results in a greater proportion of negative charges and these made up mostly of proteins that have acquired a negative charge.[1]**

Paraphrasing highly technical language

We have established that taking a paragraph, or for that matter, even a sentence from another source, and using it in our own writing without enclosing the material in quotations can constitute plagiarism. Similarly, inappropriate paraphrasing may also be classified as plagiarism.

The available evidence indicates that one of the reasons writers misappropriate text is because they may be unfamiliar with the concepts and/or language with which s/he is working. The ability to properly paraphrase technical text depends in large part on an author's conceptual understanding of the ideas being processed and his/her mastery and command of the technical language involved. Accordingly, correct paraphrases are easy when the language of the original material allows us many options for substituting words and phrases. Research shows that when asked to paraphrase, students, as well as university professors, are more likely to appropriate and, therefore, plagiarize text when the original material to be paraphrased is made up of technical language and it is difficult to read than when the material is written in plain language and is easier to read.

> *Obviously, inexperienced authors (e.g., students) have the greatest difficulty paraphrasing the advanced technical text often found in the primary literature. In an effort to introduce them to primary sources of information in a given discipline, college students are often required to write a research paper using only articles from professional journals. For those students who must complete this type of assignment for the first time, and, in particular, for foreign students whose primary language is not English, writing a research paper can be a daunting task. This is because scholarly prose: 1) can be very intricate, 2) adheres to unique, stylistic conventions (e.g., use of the passive voice in the biomedical sciences), and 3) relies heavily on jargon that novice writers have yet to master. Consequently, students' need to create an acceptable academic product that is grammatically correct and that demonstrates knowledge of the concepts discussed, forces many of them to rely on close paraphrases of the original text. Unfortunately, such writing can result in a charge of plagiarism.*

Guideline 7: In order to make substantial modifications to the original text that result in a proper paraphrase, the author must have a thorough understanding of the ideas and terminology being used.

An analogous situation can occur at the professional level when we wish to paraphrase, say, a complex process or methodology. Traditional writing conventions give us the option to use any material that is difficult to paraphrase by enclosing it in quotation marks with some type of indication (e.g., a footnote) as to its origin. Therefore, if the text is so technical that it would be very difficult or near impossible to modify substantially without altering its meaning, then perhaps it would be best to leave it in the original author's wording, enclose it in quotation marks, and include a citation. However, unlike literature or philosophy, quoting in certain disciplines (e.g., biological sciences) is not encouraged (see Pechnick, 2001). One would be hard pressed to find an entire sentence quoted, let alone a short paragraph, in the pages of prestigious journals in the biomedical sciences (e.g., Nature, Science, New England Journal of Medicine).

In sum, the reality is that traditional scientific prose and diction do not always facilitate paraphrasing. To illustrate the difficulties inherent in paraphrasing highly technical language, let's consider the following paragraph from a report recently published

in *Science* (Lunyak, et al., 2002).

> **"Mammalian histone lysine methyltransferase, suppressor of variegation 39H1 (SUV39H1), initiates silencing with selective methylation on Lys^9 of histone H3, thus creating a high-affinity binding site for HP1. When an antibody to endogenous SUV39H1 was used for immunoprecipitation, MeCP2 was effectively coimmunoprecipitated; conversely, αHA antibodies to HA-tagged MeCP2 could immunoprecipitate SUV39H1 (Fig. 2G)."[2] (p. 1748)**

Here is an attempt at paraphrasing the above material:

> A high affinity binding site for HP1 can be produced by silencing Lys^9 of histone H3 by methylation with mammalian histone lysine methyltransferase, a suppressor of variegation 39H1 (SUV39H1). MeCP2 can be immunoprecipitated with antibodies prepared against endogenous SUV39H1; on the other hand, immunoprecipitation of SUB39H1 resulted from aHA antibodies to HA-tagged MeCP2. [2]

Unlike the previous examples of appropriate paraphrasing, the above example does not embody as many textual modifications. For the exact meaning of the original *Science* paragraph to be preserved in the present case, many of the same terms must be left intact in the paraphrased version. Although synonyms for some of the words may be available, their use would likely alter the meaning of the original. For example, take the word *affinity*, which is defined as "that force by which a substance chooses or elects to unite with one substance rather than with another" (Dorland, 2000). *Roget's Thesaurus* (Chapman, 1992) lists the following synonyms for *affinity: accord, agreement, attraction, friendship, inclination, marriage relationship, preference, relationship, similarity, and tendency.* Although it might be possible to rewrite the first sentence using the synonym "*attraction*", this alternative fails to capture the precise meaning conveyed by the original sentence, given how the term is used in this area of biomedical research. The fact of the matter is that the word *affinity* has a very specific denotation in the context in which is being used in the *Science* paragraph and it is the only practical and meaningful alternative available. The same can be said for other words that might have synonyms (e.g., binding, silencing, site). Other terms, such as *methylation* and *antibodies* are unique and do not have synonyms available. In sum, most of the terms (e.g., immunoprecipitation, endogenous, coimmunoprecipitated) and expressions (e.g., HA-tagged, high-affinity, mammalian histone lysing methyltransferase) in the above paragraph are extremely difficult, if not impossible, to substitute without altering the intended meaning of the paragraph. As a result, the paraphrased version looks somewhat similar to the original and thus, applying the strict definitions of paraphrasing, such as those provided by some writing guides would render our paragraph as a borderline or an outright case of plagiarism.

Perhaps in recognition of the fact that highly technical descriptions of a methodology, phenomena, etc., can be extremely difficult, if not impossible, to properly

paraphrase, ORI's definition of plagiarism provides the following caveat:

> "ORI generally does not pursue the limited use of identical or nearly-identical phrases which describe a commonly-used methodology or previous research because ORI does not consider such use as substantially misleading to the reader or of great significance."

The above considerations may underlie the reason for the absence of an operational definition of proper paraphrasing. Nevertheless, and in spite of the above clarification provided by ORI, the following guideline is offered:

Guideline 8: A responsible writer has an ethical responsibility to readers, and to the author/s from whom s/he is borrowing, to respect others' ideas and words, to credit those from whom we borrow, and whenever possible, to use one's own words when paraphrasing.

Plagiarism and common knowledge

As has been pointed earlier, one must give credit to those whose ideas and facts we are using. One general exception to this principle occurs when the ideas we are discussing represent 'common knowledge'. If the material we are discussing is assumed to be known by the readership, then one need not cite its origin. Suppose you are an American student writing a paper on the history of the United States for a college course and in your paper, you mention the fact that George Washington was the first president of the United States and that the Declaration of Independence was signed in the year 1776. Must you provide a citation for that pair of facts? Most likely not, as these are facts commonly known by average American college and high school students. The general expectation is that "everybody knows that". However, suppose that in the same paper the student must identify the 23rd president and his running mate and the main platform under which they were running for office, plus the year they both assumed power. Should such material be considered common knowledge? The answer is probably no. It is doubtful that the average American, would know those facts. In fact, I had to look up the answers.

Let's take another example. Imagine that we are writing a paper and in it we have a need to discuss the movement of sodium and potassium ions across a cell's membrane (see the Martini and Bartholomew paragraph above). Surely, those ideas are not common knowledge amongst college students and if they were expected to use those concepts in a paper they would be required to provide a citation. However, let's suppose that the individual writing the paper was a seasoned neuroscientist and that she intended to submit her paper for publication to a professional journal. Would the author need to provide a citation for that material? Not necessarily. Although for the non-scientist the description of the concentration gradients of sodium and potassium ions inside neurons may look sufficiently complex and unfamiliar, the material is considered common knowledge

amongst neuroscientists. It would, indeed, be shocking to find a neuroscientist or biologist who was not familiar with those concepts.

In sum, the question of whether the information we write about constitutes common knowledge is not easily answerable and it depends on several factors, such as who the author is, who the readers are, and the expectations of each of these groups. Given these considerations, we recommend that authors abide by the following guideline:

Guideline 9: When in doubt as to whether a concept or fact is common knowledge, provide a citation.

Plagiarism and authorship disputes

Consider the following scenario. Two researchers who have collaborated on various projects have, in the past, have jointly published a number of papers. Three quarters into the writing of the manuscript from their most recent joint projects, the researchers experience a profound difference of opinion regarding the direction of the current project and the incident leads to the eventual break-up of their research association. Soon after, one of the researchers moves to another institution in another country and begins to pursue a different line of research. A year later, the remaining researcher decides to finish writing the manuscript and submits it for publication with his name as sole author. By appropriating the joint manuscript and submitting it under his name, has this other researcher committed plagiarism?

Let's consider another scenario, a graduate student working under her mentor's supervision makes an interesting discovery as part of her doctoral thesis work. Before she is ready to publish her thesis, however, her mentor feels that the discovery merits immediate publication and decides to report her data, along with other data he had collected from other graduate fellows working in his lab, in a journal article. The mentor does not list the graduate student's name as a co-author nor is there a byline in the article indicating the exent of her contribution under the pretext that the student's contribution in and of itself did not merit authorship.

Clearly, the above scenarios represent ethical breaches that many individuals and institutions, including the National Science Foundation, would consider as instances of plagiarism. However, not everyone agrees that these types of cases are plagiarism. For example, ORI classifies these problems not as plagiarism, but as **authorship disputes**. The involved parties can avoid these and other troublesome situations, such as disputes regarding the order of authorship of a paper, by discussing and agreeing on a plan BEFORE work on a project commences.

Additional discussion and guidance on these matters can be found in the section titled: "Authorship issues and conflicts of interest".

As this document illustrates, there are many varieties of plagiarism. Although we have covered some of the most common forms, these can be combined in a variety of ways to form new types of plagiarism not discussed here. In the next section we turn our attention to the problem of self-plagiarism.

SELF-PLAGIARISM

When plagiarism is conceptualized as theft, the notion of self-plagiarism may seem impossible. After all, one might ask: Is it possible to steal from oneself? As Hexam (1999) points out, it is possible to steal from oneself as when one engages in embezzlement or insurance fraud. In writing, self-plagiarism occurs when authors reuse their own previously written work or data in a 'new' written product without letting the reader know that this material has appeared elsewhere. According to Hexam, "… the essence of self-plagiarism is [that] the author attempts to deceive the reader".

Although in scholarly and scientific writing there are some situations in which some forms of text reuse are acceptable, many other instances in which text and/or data are known to have been reused violate the ethical spirit of scholarly research. The concept of ethical writing, about which this instructional resource revolves, entails an implicit contract between reader and writer whereby the reader assumes, unless otherwise noted, that the material was written by the author, is new, is original and is accurate to the best of the author's abilities. In this section we review some of the most common instances of self-plagiarism and provide guidelines to avoid these pitfalls.

The available literature on self-plagiarism is concerned with four major problems: The publication of what is essentially the same paper in more than one journal, but without any indication that the paper has been published elsewhere (i.e., redundant and duplicate publication), the partitioning of a large study which should have been reported in a single paper into smaller published studies (i.e., salami-slicing), copyright infringement, and the practice of text recycling. We now examine these issues in more detail.

Redundant and Duplicate (i.e., dual) Publications

A large proportion of scientific and scholarly research is carried out by college and university professors. For these academics, the presentation and subsequent publication of research in peer-reviewed scholarly and scientific journals represents one of the most important criteria for gaining tenure and/or promotion. Consequently, the more publications authored by an academic, the better his/her chances of getting a promotion or tenure. The current academic reward system is thought to produce a tremendous amount of

pressure to generate as many publications as possible. Unfortunately, some of the most serious negative outcomes of the present system are the problems of duplicate publication and of redundant publication. In the sciences, duplicate publication generally refers to the practice of submitting a paper with the same data to more than one journal, without alerting the editors or readers to the existence of other identical published versions. The new publication may differ only slightly from the original by, for example, changes to the title, abstract, and/or order of the authors. Papers representing instances of duplicate publication almost always contain identical or nearly identical text relative to the earlier published version. The related and more frequent practice known as redundant publication occurs when researchers publish the same data, with a somewhat different textual slant within the body of the paper. For example, redundant papers may contain a slightly different interpretation of the data or the introduction to the paper may be described in a somewhat different theoretical or empirical context. Sometimes, additional data or somewhat different analyses of the same, previously published data are reported in the redundant paper. The fact of the matter is that each of these types of practices is frowned upon by most scientific journals (see Kassirer & Angell, 1995) and most of the major scientific writing guides caution against them (e.g., Iverson, et al., 1998).

While the accepted practice for authors of manuscripts that are intended to be published as trade books is to send their manuscript to several publishers, the standard practice for authors of scientific or scholarly papers is to submit their paper for publication to a single journal. An author may submit the same paper or a revised version of it to another journal once it is determined that the first journal will not publish it. Only under exceptional circumstances would it be acceptable for a paper published in one journal to appear in another journal. In spite of these universally accepted practices, redundant publication[1][1] continues to be a problem in the biomedical sciences. For example, in a recent editorial, Schein (2001) describes the results of a study he and a colleague carried out in which the authors found that 92 out of 660 studies taken from 3 major surgical journals were actual cases of redundant publication. While some authors have estimated that between 10% to 20% of the biomedical literature is laden with redundant publications (Jefferson, 1998), a recent review of the literature suggests the more conservative figure of approximately 10% (Steneck, 2000). The current situation has become so serious, however, that many biomedical journals have begun to publish policies clarifying their opposition to multiple submissions of the same paper. Some journals now request that authors who submit a manuscript for review must also submit previously published papers or those that are currently under review that are related to the topic of the manuscript under consideration. This requirement has been implemented to allow editors to determine whether the extent of overlap between such papers warrants the publication of yet another paper. If, in the opinion of the editor, the extent of overlap were substantial, the paper would likely not be published.

Instances in which dual publication may be acceptable

Some authors who submit the same article to more than one journal do so with the rationale that their paper would be of interest to each set of readers who would probably not otherwise be aware of the other publication. Indeed, circumstances have been identified which would justify the dual publication of a paper. However, the editors of both journals would have to agree to this arrangement and the existence of each version of the published paper would have to be made clear to each set of readers. Blancett, Flanagin, & Young (1995; cited in Iverson, et al., 1998) provide a number of scenarios where dual publication may be acceptable (see also the International Committee of Medial Journal Editors' Uniform Requirements for Manuscripts Submitted to Biomedical Journals, updated, 2006). For example, summaries or abstracts of papers that are published in conference proceedings are often subsequently published in expanded form as a journal article. Another situation where redundant publication may be acceptable occurs when an article published in one language is translated into a different language and published in a different journal. In these and other cases where redundant publication is being considered by the author, the editors and the readers of each paper must be made aware that a second published version exists.

Why redundant publication must be avoided

Journal space is notoriously competitive in scholarly and scientific publishing, thus a paper that appears in two different journals unbeknownst to readers and editors robs other authors the opportunity to publish their worthwhile work. Moreover, referees often volunteer their valuable time to review authors' work in the service of science and scholarship. Duplicate or redundant publications waste the time and limited resources of the editorial and peer review system. More importantly and particularly in the sciences, is the fact that dual/redundant publications mislead researchers as to the true nature of a given database. For example, an author who wishes to study the significance of an experimental effect or phenomenon using sophisticated statistical techniques, such as meta-analysis, will arrive at erroneous results and conclusions if the same experiment were to be counted twice. Consider the following anecdote reported by Wheeler (1989):

> "In one such instance, a description of a serious adverse pulmonary effect associated with a new drug used to treat cardiovascular patients was published twice, five months apart in different journals. Although the authors were different, they wrote from the same medical school about patients that appear identical. Any researcher counting the incidence of complications associated with this drug from the published literature could easily be misled into concluding that the incidence is higher than it really is." (p.1).

It should be clear to the reader that redundant and duplicate publication must be avoided, for it has the potential for distorting the existing data base, possibly resulting in the establishment of flawed public health policies.

Guideline 10: Authors who submit a manuscript for publication containing data, reviews, conclusions, etc., that have already been

disseminated in some significant manner (e.g., published as an article in another journal, presented at a conference, posted on the internet) must clearly indicate to the editors and readers the nature of the previous dissemination.

Academic Self-plagiarism (Double-dipping)

Redundant publication has a direct counterpart in the area of academic dishonesty- it is referred to as ‘double dipping’. It occurs when a student submits a whole paper or a substantial portion of a paper to fulfill a course requirement, even though that paper had earlier been submitted to satisfy the requirements for another course taught by a different professor. Many college undergraduates and even some graduate students are not aware that this type of practice is a serious offense and constitutes plagiarism. Of course, as in redundant publication, submitting the same paper, or a large portion of a paper, to two different courses is entirely acceptable if the instructors of both courses were informed by the student of the double submission, and if both agreed to the arrangement. However, some institutions have specific policies prohibiting this practice.

Salami Slicing (i.e., data fragmentation)

Although often associated with redundant publication, the segmenting of a large study into two or more publications is somewhat different than reporting exactly the same data in two publications, but it is a similarly unacceptable scientific practice. As with redundant publication, **salami slicing** can lead to a distortion of the literature by leading unsuspecting readers to believe that data presented in each salami slice (i.e., journal article) is derived from a different subject sample. Consider the examples provided by Kassirer and Angell (1995), former editors of The New England Journal of Medicine:

> “Several months ago, for example, we received a manuscript describing a controlled intervention in a birthing center. The authors sent the results on the mothers to us, and the results on the infants to another journal. The two outcomes would have more appropriately been reported together. We also received a manuscript on a molecular marker as a prognostic tool for a type of cancer; another journal was sent the results of a second marker from the same pathological specimens. Combining the two sets of data clearly would have added meaning to the findings.” (p. 450).

A related malpractice known as **data augmentation** occurs when a researcher publishes a study and subsequently collects additional data, which typically end up strengthening the original effect, and publishes the combined results as a new study. The reader is mislead into believing that the data from the new study is derived from a sample that is different than the one from which the initial data were derived.

As with redundant and duplicate publication practices, these types of misrepresentations can distort the conclusions of literature reviews if the various segments of a salami publication or the augmented data that represent data from the same subject sample, are included in a meta analysis under the assumption that all of the data are derived from independent samples. For this reason, data augmentation or fragmentation can have serious negative consequences for the integrity of the scientific database. In certain key areas of biomedical research the consequences can result in policy recommendations that could have adverse public health effects.

Guideline 11: Authors of complex studies should heed the advice previously put forth by Angell & Relman (1989). If the results of a single complex study are best presented as a 'cohesive' single whole, they should not be partitioned into individual papers. Furthermore, if there is any doubt as to whether a paper submitted for publication represents fragmented data, authors should enclose other papers (published or unpublished) that might be part of the paper under consideration (Kassirer & Angell, 1995). Similarly old data that has been merely augmented with additional data points and that is subsequently presented as a new study is an equally serious ethical breach.

One element likely to be common to both redundant publication and salami publication is the potential for copyright infringement. This is because data or text (or both elements) appearing in one copyrighted publication will also appear in another publication whose copyright is owned by a different entity. Let's turn our attention now to this topic.

Copyright Law

Because some instances of plagiarism and self-plagiarism (e.g., redundant publication) have the potential for violating copyright law, the following section is devoted to a brief review of the concept of copyright.

Copyright law is based on Article 1, sec. 8, cl. 8 of the United States Constitution. It's fundamental purpose was "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries". Once owners of an artistic (e.g., song, lyrics, films) or an intellectual work (e.g., book, article) copyright a product, they have the exclusive right to publish, reproduce, sell, distribute, or modify those products. For authors who wish to have their papers published in traditional journals, the typical arrangement is for the copyright of the author's work to be transferred to the publisher of the journal. The journal

can then reproduce and distribute the author's work legally. An increasing number of journals now allow the author to maintain ownership of their work, but both entities sign an agreement specifying the journals' right to publish and re-use the author's material. In the case of "Open Access" journals (freely available to the public without expectation of payment), the author agrees to allow for the free dissemination of his/her works without prior permission.

With some exceptions, the unauthorized use of copyrighted work violates copyright law and represents copyright infringement. Exceptions to copyright infringement fall under the doctrine of "Fair Use" of copyright law and represent instances in which the activity is largely for nonprofit educational, scholarship, or research purposes (see US Copyright Office, 1996). For example, in some situations, a student or individual researcher may make a copy of a journal article or book chapter for his/her own personal use without asking permission. Likewise, an author describing the results of a published study may take a couple of lines of data from a table from a journal article, include a citation, and reproduce it in his/her paper. The American Medical Association's Manual of Style (Iverson, et al., 1998) provides additional examples of instances of "fair use".

Copyright Infringement, fair use, and plagiarism

The use of relatively short direct quotes from a published work does not usually require permission from the copyright holder as it typically falls under the "fair use" provision. However, extensive quoting of text from a copyrighted source can constitute copyright infringement, whether the appropriated text is properly enclosed in quotation marks or correctly paraphrased, even if a citation is provided according to established scholarly conventions. Obviously, the same applies if the material is plagiarized outright. Moreover, the reader should note that intellectual or artistic work does not need to be published in order to be copyrighted. In fact, the moment the work becomes final it is automatically copyrighted. Thus, instances of plagiarism, whether from a published article or an unpublished manuscript, such as a grant proposal, can also constitute copyright infringement, though copyright infringement does not always constitute plagiarism.

Iverson, et al., (1998) cautions the reader that the amount of text that can be taken from a copyrighted source without permission depends on its proportion to the entire work. However, the reader should also note that some publishers have established word limits for borrowing text. For example, according to the Publication Manual of the American Psychological Association (APA), authors who wish to borrow text of more than 500 words from a published APA publication must seek permission from the APA.

Given the above considerations, it should be clear that redundant or duplicate publication, which occurs without the respective editors' knowledge, is not only considered a form of self-plagiarism, but it may also qualify as copyright infringement because the copyright may be held by the publisher; not by the author. This would certainly be the case if the original article were published in a journal owned by one

publisher and the second article were to appear in a journal owned by a different publisher.

Guideline 12: Because some instances of plagiarism, self-plagiarism, and even some writing practices that might otherwise be acceptable (e.g., extensive paraphrasing or quoting of key elements of a book) can constitute copyright infringement, authors are strongly encouraged to become familiar with basic elements of copyright law.

Text recycling

Programmatic research often involves publishing papers describing empirical investigations that use nearly identical or identical methodologies. Similarly, the background literature reviewed in one paper may be similar or exactly the same as that of related papers by the same author/s. Therefore, it is possible to have two or more papers describing legitimately different observations that contain almost identical methodology, literature reviews, discussions, and other very similar or even identical textual material. Given the enormous pressure to publish felt by many researchers and the ease with which text can be manipulated with word processing software, these situations present unique challenges because of the allure to simply use as templates portions of text written for previously published papers and include the recycled material in a new paper. Thus, we define text recycling as a writer's reuse of portions of text that have appeared previously in other works.

As with the problem of inappropriate paraphrasing, the question of how much a writer may recycle from his/her previous writings has not been generally addressed in the writing literature. In fact, of the concepts reviewed so far, text recycling is perhaps the most problematic because few, if any, official guidelines exist and because when it does occur, it is generally not found to be consistent with the principles of ethical writing. Given that the present instructional resource is grounded in those very principles, some sensible guidelines can be derived.

Forms of acceptable text recycling

As with redundant publication, certain types of text recycling appear to be acceptable within the biomedical and social sciences even though they seemingly violate the spirit of the writer's implicit contract. Here are specific examples.

<u>Recycling text from an Institutional Review Board (IRB) application, Animal Care and Use Committee, Grant application, or other form of unpublished 'internal' proposal.</u> Academics and researchers who write research proposals, either for the purpose of seeking funding or for internal or ethical review, will often use the same material, though likely in expanded form, in a paper that is later published. This is an accepted practice because these

proposals are typically never published and are only reviewed by a very small number of individuals. On the other hand, in some instances there may be proprietary copyright issues with respect to an unpublished proposal or report that was originally written for a private enterprise when the author was employed by that institution. Therefore, in these cases permission to subsequently publish portions of material originally written for use by, say, a corporate entity should be sought. On the other hand, the recycling of text from IRB, grants, and other types of proposals reviewed within academic institutions is generally considered an acceptable practice.

Recycling papers given at a conference. Often, scientists who make presentations at conferences distribute preliminary copies of their papers to the audience. Sometimes after the presentation, and perhaps based on the audience's feedback of the scientist's presentation, some modifications are made to the paper and it is subsequently submitted for publication to a journal. This practice is also generally acceptable. However, there are instances where some caution should be observed. For example, in cases where the conference abstracts or even the preliminary papers themselves are subsequently published as proceedings by the sponsoring organization, the author should inquire as to whether that organization permits republication of their materials. Authors should also keep in mind that some editors may consider the above scenario as a case of redundant publication. Therefore, they should always inform an editor if an abstract or a brief version of a paper being submitted for publication has already appear in the proceedings of a conference. Lastly, in cases where a published paper is based on a conference presentation, the standard practice is to also inform the reader about its prior version. This is usually done in the form of a footnote or endnote. To further clarify the nature of these two products, authors are also strongly encouraged to insure that the both, the paper presented at a conference and its published version share the same or similar title.

'Borderline'/unacceptable cases of text recycling

Recycling sections of a complex method section from a previously published paper. In writing methodology sections of empirical papers, one of the goals of authors is to provide all the necessary detail so that an independent researcher can replicate the study. Because these sections are often highly technical and can be laborious to write, authors of multiple papers using the same methodology will sometimes recycle text with little or no modification from a previously published paper and use it in a new paper. Technically, if an author were to adherence to the 'implicit contract' between reader and writer embodied in the concept of ethical writing and to the strict rules of proper scholarly conduct, s/he would need to put any verbatim text from the method section in quotation marks and appropriately paraphrase any other recycled text that is not placed in quotations. Curiously, such practice is seldom, if ever, followed in these instances. Instead, what seems to have become a routine practice for authors is to recycle, with some minor modifications, substantial portions of these sections (see Roig, 2002). Judging by instructions to authors in at least one journal, it appears that, in the past, some authors have not bothered to make even minor changes when they repeatedly recycle the same method section from article to article. For example, in a section titled "Avoidable errors in manuscripts" Biros (2000),

editor-in-chief of Academic Emergency Medicine writes:

> *"Methods are reported that were not actually used. [This] most frequently occurs when an author has published similar methods previously and has devised a template for the methods which is used from paper to paper. Reproducing the template exactly is self-plagiarism and can be misleading if the template is not updated to reflect the current research project." (p. 3).*

In addition to constituting self-plagiarism, there is another reason why this practice may be problematic. Consider the following scenario: An author takes a substantial amount of text from one of her papers that had been published in a journal owned by one publisher and recycles that text in a paper that will now be published by a journal owned by a different publisher. In this situation, the author may be violating copyright rules. Thus, Biros (2000) also cautions that:

> *"Many authors do not understand the implications of signing the copyright release form. In essence, this transfers ownership of the paper and all of its contents from the author to the publisher. Subsequent papers written by the same author therefore must be careful not to reproduce in any way material that has previously been published, even if it is written by them. Such copying constitutes self-plagiarism." (p. 4).*

Yet, another situation that may be problematic occurs when a member of one team of authors who wrote the original method section is not one of the authors who recycles that method section in a later publication. Here the potential for an accusation of plagiarism could easily develop.

On the other hand, as discussed earlier, methodology sections often include very intricately complex descriptions of procedural processes that are laden with unique terminology and phraseology for which there are no acceptable equivalents (e.g., *Mammalian histone lysine methyltransferase, suppressor of variegation 39H1 (SUV39H1)*. Even when major textual modifications to these sections are possible, a change in the language can run the risk of slightly altering the intended meaning of what is being described and such an outcome is a highly undesirable in the sciences. Thus authors should be allowed some latitude in terms of the extent to which they should modify portions of text when paraphrasing material from methodology sections that is highly technical in nature, even if the material is derived from other sources.

Guideline 13: While there are some situations where text recycling is an acceptable practice, it may not be so in other situations. Authors are urged to adhere to the spirit of ethical writing and avoid reusing their own previously published text, unless it is done in a manner consistent with standard scholarly conventions (e.g., by using of quotations and proper paraphrasing).

Substantial text recycling, as well as the other forms of self-plagiarism reviewed above, suggest at the very least a degree of intellectual laziness. At worst, these practices can result in serious consequences to the scholarly and scientific literature, to public health, and even to the perpetrator. Authors are well advised to carefully review the editorial guidelines of journals to which they submit their manuscripts, as well as their disciplines' codes of ethics. More importantly, contributors to the literature need to be reminded that they are always held to the highest standards of ethical conduct.

THE LESSER CRIMES OF WRITING: OTHER QUESTIONABLE WRITING PRACTICES

Recently, Zigmond and Fischer (2002) have called attention to what they refer as the "misdemeanors" of science: Ethically inappropriate practices in the conduct of scientific research. These authors explain that, whereas fabrication, falsification, and plagiarism are considered to be the "high crimes" of science, many other inappropriate practices frequently take place and these lesser crimes should command more attention. Some examples of common misdemeanors are, neglecting to indicate one's source of funding, failing to identify possible conflicts of interest, and establishing honorary authorship (assigning authorship to an individual whose contributions to the work do not earn him/her such status).

We can apply the high crimes vs. misdemeanors classification in the area of writing. In our previous discussion of plagiarism and self-plagiarism, we described a variety of practices, some of which would undoubtedly be classified as high crimes (e.g., appropriating the ideas or data of someone else without attribution), while others would fall under the misdemeanor category (e.g., inadequate paraphrasing). In this section, we turn our attention to other practices that violate the spirit of ethical writing and that fall under Zigmond & Fischer's (2002) misdemeanor category.

ETHICALLY QUESTIONABLE CITATION PRACTICES

Citations and References

Citations are the notations in the text of a paper that identify the source of our claims, other research and theories mentioned in the paper. Depending on the style of writing used these are typically represented as numbers in parentheses or in superscript (e.g., AMA) or as last names with dates (e.g., APA). The list of references is always found at the end of a paper and these contain sufficient detail for readers to track down copies of these works (e.g., names of the authors, titles of articles or books, journal title, volume number, pagination and year of publication).

Carelessness in citing sources

References provide a crucial service in scholarly and scientific writing for they allow the reader to explore in more detail a given line of thinking or evidence. For these reasons, it is important that authors strive for accuracy when listing references in manuscripts. Unfortunately, it appears that authors do not always give the proper level of attention to citations and reference sections. In fact, the available evidence suggests that a disproportionate number of errors occur in reference sections even in some of the most prestigious biomedical journals (e.g., Siebers and Holt, 2000).

The importance of citing the original observation

Another area of concern is the failure to cite the author who first reports the phenomenon being studied. Apparently, some authors instead cite later studies that better substantiate the original observation. However, as Zigmond and Fischer (2002) note, failure to cite the original report denies the individual who made the initial discovery his/her due credit.

GUIDELINE 14: Authors are strongly urged to double-check their citations. Specifically, authors should always ensure that each reference notation appearing in the body of the manuscript corresponds to the correct citation listed in the reference section and vice versa and that each source listed in the reference section has been cited at some point in the manuscript. In addition, authors should also ensure that all elements of a citation (e.g., spelling of authors' names, volume number of journal, pagination) are derived directly from the original paper, rather than from a citation that appears on a secondary source. Finally, authors should ensure that credit is given to those authors who first reported the phenomenon being studied.

Inappropriate Manipulation of References

In a later section I discuss the tendency on the part of some scientists to provide what may be a biased review of the relevant literature. That is, in providing a context for the presentation of our data or theory, we sometimes cite only references that are favorable to our position. However, ethical writers have a responsibility to cite all relevant material, even work that may contradict our own point of view. Failure to do so compromises our objectivity and is contrary to the primary mission of a scientist which is to search for truth.

Citation Stuffing

Another way in which references are thought to be inappropriately manipulated occurs when authors intentionally cite their own articles, regardless of their relevance, in an attempt to raise their own articles' impact factor. The impact factor is a measure of

importance and prestige of journals that takes into account how often articles published in those journals are cited. However, a measure of the number of times an article is cited in other articles can also be used as a measure of their importance in an individuals' tenure and review decisions, thus the tendency of some authors to weave into their paper references of their own prior work that are largely irrelevant to the current topic.

A related matter involves the inappropriate inclusion of references that are authored by individuals thought to be likely peer reviewers of the article in question. The thought being that the reviewer will be more likely to give a favorable review to a paper that cites his or her own work than to one that does not.

Finally, there is some evidence that editors of some journals sometimes insist that authors include references from their journal for the mere purpose of enhancing that journal's impact factor (see WAME discussion of March 7th to the 16th, 2006: Manipulating a Journal's Impact Factor). Authors should attempt to resist such requests unless the editors' recommendations are genuinely relevant to their paper.

GUIDELINE 15: The references used in a paper should only be those that are directly related to its contents. The intentional inclusion of references of questionable relevance for purposes of manipulating a journal's or a paper's impact factor or a paper's chances of acceptance is an unacceptable practice.

Relying on an abstract or a preliminary version of a paper while citing the published version

At the beginning of this instructional resource we identified clarity, conciseness, accuracy, and integrity as essential elements of scientific writing. Unfortunately, the latter two concepts are sometimes overlooked with certain citation practices. Consider what can happen in the following scenario. A researcher needs to conduct a literature review for a manuscript that he is preparing for submission to a biomedical journal. She begins her search by accessing the PubMed database and typing topic-relevant terms in the search field. The search yields several useful abstracts and the researcher proceeds to track down the various journal articles. Unfortunately, one key article is not available on-line. It is not carried by her institution's library, nor is it available at nearby libraries as it has been published as a technical report in a nontraditional journal with very limited circulation. Pressed for time, the researcher decides, instead, to rely on material from the abstract for the literature review and includes the journal article citation in the reference section. However, she fails to indicate that she relied on the abstract and not the actual journal article.

Another variation of this problem occurs when the researcher cites the published version of the paper, but actually relies on the contents of an earlier version that was published in the proceedings of a conference, or the preliminary version that was distributed at the conference presentation itself. These behaviors violate the requisites of accuracy and integrity.

The main problem with relying on versions other than the published paper is that important elements of these earlier versions may be different from their counterparts in the published version of the paper. Such changes are typically due to the peer review process, editorial changes, or errors that are spotted and corrected by the author between the time the paper is presented at a conference and the time that it is subsequently published. In some cases, the published version will contain additional data and/or interpretations that are substantially different or perhaps even contrary to those of earlier versions. For example, a conference paper describing experimental data may, in its published form, may contain additional data from a new experimental condition that was run in response to referees' suggestions. Data from the new condition can place the earlier data in a new perspective possibly leading to new interpretations. Again, with respect to abstracts, relying on such summaries can be problematic because abstracts typically do not provide sufficient details about the paper's contribution (i.e., Taylor, 2002). In addition, because of their condensed form, abstracts cannot provide essential details about a study's methodology, and results. Moreover, we note that in some databases there may be instances in which individuals other than the author/s of the journal article write the article's abstract. As a result, subtle misrepresentations are more likely to occur. Writing guidelines, such as the Uniform Requirements for Manuscripts Submitted to Biomedical Journals, discourage the use of abstracts as references.

GUIDELINE 16: Authors should follow a simple rule: Strive to obtain the actual published paper. When the published paper cannot be obtained, cite the specific version of the material being used, whether it is conference presentation, abstract, or an unpublished manuscript.

Citing sources that were not read or thoroughly understood

The practice of relying on a published paper's abstract to describe its contents also fits in the present category. However, there are other scenarios that better illustrate the practice of citing papers that were either poorly understood or perhaps not even read by the author citing them. Let's go over a couple of examples:

Consider an investigator who is in the process of writing the results of a series of studies he conducted. In his search for background literature relevant to his work, he finds one particular journal article whose introduction cites a number of other works that seem very relevant to his own paper. Although he recognizes most of the references cited, there

are a couple of papers that he is not familiar with and, unfortunately, for a variety of reasons he cannot obtain copies of them at this point. Given the context of the published paper's description of these two other papers that are unfamiliar to him, our author decides to include them in his own review of the literature by paraphrasing the relevant portions of the published paper's introduction that summarize the contributions of these two unfamiliar papers. He then includes these papers as references in his manuscript's reference section, along with the journal article from which he derived the information. Finally, although our author cites the published article in at least one other context, he does not indicate that this article had served as the source of the paraphrase.

By not indicating the true source of the paraphrase of these two papers, the reader is deceived by falsely assuming that the brief summary of these two papers was based on our author's direct reading of these papers. Technically, this type of transgression qualifies as a form of plagiarism because the author has paraphrased a summary of another's work that was written by someone else and has not properly attributed his summary to the author of the journal article. Of course, a formal charge of plagiarism would depend on a number of variables, such as the amount of paraphrasing that took place without proper attribution, the significance or uniqueness of the material involved, etc.

This type of deceptive practice can also be risky because there could conceivably be other aspects of the papers cited (but which were not read) that do not quite correspond with the offending author's thesis. Therefore our author may be citing references that do not entirely support his data or point of view. Inexperienced students sometimes use this inappropriate strategy when they review the literature and discover a paper that reviews roughly the same literature that the student must describe. In an effort to optimize his time and given the effort needed to write a proper paper some students will paraphrase, in whole or in part, a review of the same literature that has already appeared in a published source. In an effort to maintain the deception, the student cites in his/her paper's reference section every source mentioned in the paraphrase, including the article from which the material was taken. This strategy is designed to mislead the professor into assuming that the student has actually read all of the papers cited in his/her review. Ironically, these transgressions are typically uncovered, not only because the students' paraphrases are often too close to the original, thus betraying the students' less sophisticated writing, but also because at least some of the papers cited are known to their professor to not be directly supportive of the students' main position. Other clues in the writing often point to the deception.

The reader should note, however, that there might be instances in which the practice of citing sources that were not read may be acceptable. For example, an author may simply wish to point out a well-known discovery or theory and provide the reader with the original citation. When this is done without misleading the reader into believing that the author read the paper detailing the discovery and is thoroughly acquainted with its contents, then no real harm is done.

GUIDELINE 17: Generally, when describing others' work, do not rely on a secondary summary of that work. It is a deceptive practice,

reflects poor scholarly standards, and can lead to a flawed description of the work described. Always consult the primary literature.

The reader should note that some writing manuals have spelled out specific conventions to deal with a situation when an important paper relevant to one's manuscript contains a reference that we would like to cite, but is not available to us. One such writing manual, the current edition of the Style Manual of the American Psychological Association (American Psychological Association, 2001), offers a simple strategy for authors who need to cite a source that is not available to them, but that is contained within another source (as described in the above example). Let's say that our author had read about the work of Smith (1999) in an article authored by Rodriguez (2003). According to the APA Manual the author can use this material by stating as follows: "According to Smith (1999; as cited in Rodriguez, 2003) an important variable …". The reader may have noticed that I have already relied on this strategy elsewhere in this instructional resource.

There is at least one other milder form of citing material without having actually read it that has been identified even in seasoned writers. Consider the situation in which a 'landmark' paper, whose contributions are well known, needs to be cited in a manuscript. The author cannot readily find a copy of the paper, but he has read it at least once, cited it before, and is familiar with its contents. In summarizing the contents of that landmark paper, the author of the manuscript, who may have read the paper long ago, is relying on her recollection of its contents based on her prior reading of the paper and on summaries published by others. After all, this is a paper that is widely known throughout the discipline.

The problem with the above situation is that our recollection of vital details about a paper read at an earlier time is probably less than optimal. In addition, secondary sources may inadvertently slant or distort important details of others' work, particularly if the material in question is of a controversial nature. Taken together, these factors can ultimately result in the dissemination of faulty information.

One example of this type of problem within the social sciences concerns current descriptions of a famous demonstration carried out by psychologists John B. Watson and Rosalie Rayner (1920) in which an infant known as "Little Albert" was conditioned to fear a rat. Watson and Rayner's demonstration with Little Albert is cited in a large proportion of introductory psychology textbook and in many other textbooks within that discipline and beyond (e.g., education, nursing). However, according to Paul and Blumenthal (1989), investigators have pointed out a number of serious flaws in this classic demonstration and have also shown how, over the years, various elements of the demonstration have become distorted. For example, some descriptions of Little Albert indicate that Watson & Rayner used a white rabbit rather than a white rat. In explaining the continued presence of this classic demonstration in textbooks without mention of the flaws, Paul and Blumenthal state:

> "Textbook authors are under considerable pressure to keep their references current. An author who cites older works will often be instructed by manuscript reviewers and editors to consult the current literature. Most surely do. But from the evidence of the texts, others simply update their citations or lists of 'suggestion for further reading.' As a result, references in introductory textbooks sometimes bear little relationship to authors' substantive discussions. Indeed, citation may directly contradict claims asserted in the text." (p. 551).

GUIDELINE 18: If an author must rely on a secondary source (e.g., textbook) to describe the contents of a primary source (e.g., an empirical journal article), s/he should consult writing manuals used in her discipline to follow the proper convention to do so. Above all, always indicate the actual source of the information being reported.

Borrowing extensively from a source but only acknowledging a small portion of what is borrowed

When we write a review of the literature in the biological and social sciences we often summarize in one or more sentences, or perhaps in a short paragraph or two, the ideas or data of each source we consult. Of course, we also include proper citations within the summary. Thus, a typical review of the literature is sprinkled with numbered references in superscript as per the style outlined in the American Medical Association Manual of Style or, as is commonly done in the social sciences and in this instructional resource, parenthetical notations with last names of authors and dates, that indicate the sources of our information. There are instances, however, when an author will draw heavily from a single source. Yet, the reader will typically not see the systematic appearance of the same reference notation on every few sentences throughout the several paragraphs of the work that has been borrowed. Most authors recognize the awkwardness of this practice and manage to avoid it by providing only one or two citations strategically placed throughout the portion of text that is derived from another source and carefully crafting the writing to clearly indicate that the ideas expressed are not the author's. Some authors, however, are not as consistently creative and will sometimes intersperse their ideas with those of the source being used in away that is not clear to the reader when the contributions of the source end, and those of the manuscript's author begin. In the event that the resulting text leads the reader to interpret the borrowed ideas as having been derived by the manuscript's author, there is a risk that the author of the manuscript will be accused of plagiarism.

GUIDELINE 19: When borrowing heavily from a source, authors should always craft their writing in a way that makes clear to

readers, which ideas are their own and which are derived from the source being consulted.

ETHICALLY INAPPROPRIATE WRITING PRACTICES

Responsible science and scholarship entails the highest degree of objectivity in reporting the results of our research. Authors, often with the assistance of the editorial process, make every effort to describe their observations without exaggerating the importance of the findings or overstating their conclusion. However, lapses in preserving that high level of objectivity when presenting research to a general audience have been noted. For example, Woloshin and Schwartz (2002) have carried out an analysis of press releases and reported that these often fail to emphasize the limitations of the studies. These authors noted that “[d]ata are often presented using formats that may exaggerate the perceived importance of findings”. Their results are noteworthy because, in some cases, study authors are consulted during the editorial stages of producing a press release.

Other ethically questionable writing practices have been identified in which subtle biases are introduced in the writing process. What follows is a brief discussion of some of the most frequent problems.

Selective reporting of Literature

Whether one is working on a paper for a course, a doctoral dissertation, or a paper targeted for publication in a scientific journal, one of the main purposes of reviewing the relevant literature and citing others’ work is to provide empirical and/or theoretical support for one’s thesis. The literature review also provides readers with the proper context to understand a proposed study or theory by informing them of important issues, such as the current state of knowledge on the topic, the type of methodologies being used in the area, the theoretical underpinnings of the research, and the significance of the problem. Depending on the type of manuscript being developed, the literature review will be either comprehensive (e.g., doctoral dissertation, review article) or very succinct (e.g., journal article). The latter situation presents a unique challenge because journal space can be very expensive forcing authors to be very concise in their writing.

For aspiring scholars and scientists, the classroom represents the training ground for future professionals. As a result, professors tailor the requirements for academic papers assigned in many graduate and advanced undergraduate courses to those demanded by scholarly journals (see for example, Salazar, 1993). These constraints sometimes present a real challenge for authors, who must always make an effort to simplify their literature reviews and only include a very concise summary of highly relevant papers.

Obviously, literature that is cited in support of our point of view must be grounded in sound arguments, tight research methodologies, and flawless data. Citing references in

support of our work, that are known to be methodologically or logically deficient, and that fail to mention these shortcomings is ethically inappropriate. Likewise, if in our search for relevant literature we become aware of important relevant evidence that runs contrary to our data or point of view, we have an ethical obligation to cite such evidence, either in the introduction or the discussion section of our paper and to do so objectively. Of course, there are instances in which the extent of our review is extremely limited as, for example, when reporting in the format of a short communication or brief report. Space limitations in such contexts may be such that it is impractical to provide adequate coverage of relevant literature, let alone contrary evidence.

Given that the main purpose of a literature review is to find evidence in support of our research, it is not uncommon to find instances in which authors fail to cite relevant literature that runs contrary to their thesis. Based on the pace at which science and scholarship continues to grow, that many of these lapses may be due to authors' inability to keep up with the burgeoning literature. However, a perusal of scholarly journals that accept letters to the editor as commentaries to recently published articles will reveal instances in which such writing practices appear intentional (see Goodman, 1998; Perkin, 1999; Nathan, 1994).

GUIDELINE 20: When appropriate, authors have an ethical responsibility to report evidence that runs contrary to their point of view. In addition, evidence that we use in support of our position must be methodologically sound. When citing supporting studies that suffer from methodological, statistical, or other types of shortcomings, such flaws must be pointed out to the reader.

Selective reporting of Methodology

Replication of others' research is one of the hallmarks of the scientific enterprise. As such, scientists and scholars have a responsibility to inform others about the specific procedures used in their research. This information is typically found in the methods section of a research paper the purpose of which is to provide other researchers with sufficient details about the study so that in the event that anyone wishes to replicate the study, they will have enough information to do so. For example, we identify the subjects of our study (e.g., select clinical population, specific species of animals) and provide important details about characteristics of the sample, such as how subjects were recruited, that are relevant to the kinds of variables that are being manipulated and measured.

The Methods section also contains description of instrumentation or other observational techniques that are used in carrying out a study. Whether data were collected

using sophisticated instrumentation, such as a positron emission tomography or via a simple paper-and-pencil questionnaire, scientists must describe these materials with sufficient detail to allow other researchers to conduct the study.

Perhaps the most important part of a Methods section is the description of the actual procedure that was used to carry out the study. Here, investigators must explain in clear language the series of steps that were used to establish, observe, or manipulate the independent variables. They must offer a complete description of the testing conditions and all of the other necessary details that would allow an independent investigator to carry out the same study again. Any essential details that are inadvertently omitted from this section may lead others to carry out replication attempts that will be doomed to failure, resulting in a waste of valuable time and resources. A more serious offense occurs when an author intentionally leaves out an important detail about the procedure or a crucial event that altered the conditions of the study. There are several reasons why some authors will knowingly leave important details out of a research report. Perhaps an extraneous variable was inadvertently introduced into the study while it was in progress leading to biased results. Thus, for the sake of expediency, rather than discarding the biased results and starting all over again, the investigator may inappropriately leave that major detail out of the report. The important point here is that authors have an obligation to describe all of the important aspects of the research conducted, even if some of those details reflect poorly on his or her abilities.

Because of the concern that some investigators may at times omit important details of the methodology used, guidelines have been formulated to help authors write better research reports. For example, for reports describing randomized control trials authors are advised to consult Moher, Schultz, and Altman's (2001) Consort statement, which is a set of guidelines designed to improve the quality of such reports.

GUIDELINE 21: Authors have an ethical obligation to report all aspects of the study that may impact the independent replicability of their research.

Selective reporting of results

Designing an empirical study takes planning and careful consideration of existing theory and research in the area under investigation. When testing for simple causal relationships, it should be relatively easy to predict the specific outcome when producing a change in the causal variable. Most modern investigations, however, are far from simple as they often involve several variables all of which interact in ways that are sometimes difficult, if not impossible, to predict. One positive feature of complex studies is that they can yield many interesting outcomes, but some of these outcomes may also generate results that are contrary to our expectations. When this happens, there may be a temptation to manipulate the statistical analyses in a way that obscures the actual unwanted results obtained (e.g., using a less powerful statistical test, removing outliers), while perhaps simultaneously enhancing the hypothesized results. Another temptation is to simply not report negative results and only report those results that are consistent with our line of

thinking. Other techniques, such as the manipulation of graphs, have been used to subtly change, and therefore distort, the presentation of results in a way that make them more consistent with our hypotheses and theories. Such practices are almost always deceptive and are contrary to the basic scholarly-scientific mission of searching for truth. However, there are instances in which practices, such as the removal of outliers, are acceptable given that the author follows established procedures, informs readers of these actions, and provides a cogent rationale for carrying them out.

GUIDELINE 22: Researchers have an ethical responsibility to report the results of their studies according to their a priori plans. Any post hoc manipulations that may alter the results initially obtained, such as the elimination of outliers or the use of alternative statistical techniques, must be clearly described along with an acceptable rationale for using such techniques.

AUTHORSHIP ISSUES AND CONFLICTS OF INTEREST

An instructional resource on scholarly and scientific writing would not be complete without some discussion of conflicts of interest and authorship issues, such as the conditions that merit the granting of authorship. We now turn our attention to these matters.

Advances in biotechnology, communication, instrumentation, and computing have allowed scientists to investigate increasingly complex problems. It is not uncommon these days for large-scale investigations to be carried out by a handful of scientists from various institutions sometimes spanning two or more continents. Groups and individual contributors may work on the same or different key aspects of a project and these collaborations will invariably result in multiple-authored publications. Unfortunately, some of these collaborative efforts have given rise to disputes about authorship issues. The most frequent disputes center around the following questions: 1) Which members of a research team merit authorship? 2) Who is designated as senior author of the resulting journal article? And 3) How is the rest of the authorship order determined?

Given that authorship, particularly the designation of senior author of a paper in scientific and scholarly publications plays such a prominent role in the current merit system, it is extremely important to have sound guidelines for establishing the conditions for authorship. For example, in writing about these issues, Steinbok (1995) questions whether various situational roles in biomedical research merit authorship. He writes: “Should the head of the department automatically be an author? Should the various clinicians involved in the care of the patients who are subjects of a paper automatically be authors? What about the person who goes through a set of charts and puts information into a database? What about the statistician who analyzes the data?” (p. 324). Others have

raised questions related to the current trend for graduate and undergraduate students to be directly involved in research and in the authoring of papers.

Fortunately, individuals and a number of professional societies have proposed relevant guidelines in this area (see references in later section). Although these sets of guidelines are not identical there is sufficient overlap to offer readers certain recommendations. In considering these guidelines, readers are advised to consult their professional associations for any specific authorship guidelines that these entities may have developed. Readers are also advised to consult the institutions with which they are affiliated, as well as the individual journals to which they intend to submit a manuscript.

Deciding on authorship

Whether students or professionals, individuals collaborating on a research project should discuss authorship issues, such as who will be designated as senior author, the order of other authors, and any other individual acknowledgements for other contributions to the project, before initiating work on the project. All parties should familiarize themselves with authorship guidelines suggested by their respective disciplines. In the absence of such guidelines, prospective authors should follow the guidelines of the International Committee of Medical Journal Editors. Any agreement reached regarding authorship should be recorded in writing and should outline the formula used for determining whom the senior author should be and the authorship order for the rest of the investigators involved in the project. The agreement should be sufficiently flexible to accommodate changes that may arise while the project is in progress (e.g., an individual not initially designated as author ends up making substantive contributions that earn her authorship in the paper, or an individual previously designated as author fails to carry out the designated duties, making his contributions not sufficient or important to merit authorship).

GUIDELINE 23: Authorship determination should be discussed prior to commencing a research collaboration and should be based on established guidelines, such as those of the International Committee of Medical Journal Editors.

Establishing authorship

As per the guidelines of the International Committee of Medical Journal Editors, only individuals that make substantive intellectual contributions to the project should be listed as authors and the order of authorship should be based on the degree of importance of each author’s contribution to the project. The latter may be difficult to establish in disciplines, such as particle physics, where a team of several dozen, perhaps even over one hundred contributors, may author a single paper. Authorship entails the ability to publicly take responsibility for the contents of the project (e.g., being sufficiently knowledgeable about the project to be able to present it in a formal forum). What determines whether a

contribution is substantive or not is a matter of debate and, technically, it should not matter whether the aim of the collaboration is an internal technical report, a conference presentation, or an article targeted for refereed journal. Generally, examples of substantive contributions include, but are not limited to, aiding in the conceptualization of the hypotheses, designing the methodology of the investigation and significantly contributing to the writing the manuscript. "Mechanical" activities, such as entering information in a database or merely collecting actual data (e.g., running subjects, collecting questionnaires) are not sufficient grounds for authorship, but should be acknowledged in a footnote. In addition, "honorary" or "courtesy" authorship assigned on the basis of some leadership position (e.g., such as being head of the department where the research is carried out) must also be avoided.

GUIDELINE 24: Only those individuals who have made substantitve contributions to a project merit authorship in a paper.

Authorship in faculty-student collaborations

Undergraduates, and certainly graduate students, are increasingly involved in research collaboration with their faculty. Along with high grade point averages and scores on standardized testing, undergraduate research experience is one of the most valued criteria for advanced graduate training. As a result, an increasing number of undergraduates are becoming involved in research and authoring journal articles.

Are the authorship guidelines for students different than those for other professionals? Apparently not.

According to Fine and Kurdek (1993) who have written on these issues. According to these authors:

> *"To be included as an author on a scholarly publication, a student should, in a cumulative sense, make a professional contribution that is creative and intellectual in nature, that is integral to completion of the paper, and that requires an overarching perspective of the project. Examples of professional contributions include developing the research design, writing portions of the manuscript, integrating diverse theoretical perspectives, developing new conceptual models, designing assessments, contributing to data analysis decision and interpreting results …"* (p. 1145).

Faculty mentors might think of the above guidelines for students as being rather harsh. However, consider part of the rationale for these authors' position that awarding authorship to an undeserving student is unethical:

> *"First, a publication on one's record that is not legitimately earned may falsely represent the individual's scholarly expertise. Second, if because he or she is now a published author, the student is perceived as being more skilled than a peer who is not published, the student is given an unfair advantage professionally. Finally, if the student is perceived to have a level of competence that he or she does not*

actually have, he or she will be expected to accomplish tasks that may be outside the student's range of expertise" (p. 1143).

On the other hand, there is evidence suggesting that students' earned authorship credit is sometimes underrepresented or outright denied by supervising faculty (Swazey, Anderson, & Lewis, 1993; Tarnow, 1999). Clearly, such outcomes are equally unethical as they rob the deserving student of their due credit.

GUIDELINE 25: Faculty-student collaborations should follow the same criteria to establish authorship. Mentors must exercise great care to neither award authorship to students whose contributions do not merit it, nor to deny authorship and due credit to the work of students.

Ghost Authorship

Ghost authorship occurs when a written work fails to identify individuals who made significant contributions to the research and writing of that work. Although in recent times this unethical practice is typically associated with the pharmaceutical and biomedical device industry, the term is also applicable in a number of other contexts. For example, in academic contexts, it is widely recognized as cheating to have someone other than the named student author write a paper that is then submitted as the student's own. Perhaps with some exceptions (e.g., speech writers), ghost authorship is ethically unacceptable because the reader is mislead as to the actual contributions made by the named author.

Academic Ghost Authorship

A not uncommon form of academic dishonesty that has probably always existed is to have someone else other than the student (a friend or relative), complete an assignment or write a paper. Several Internet sites now exist that, in addition to making available copies of papers that have already been written, they also provide custom-written papers, including doctoral theses. The customer (i.e., student) specifies the topic and other requirements for the paper and, for a fee, a staff writer for the service will supply a custom-written product. For an eye-opening account of how this practice works even before the proliferation of on-line paper mill sites, I refer the reader to Whitherspoon (1995)'s personal account as a Ghostwriter.

Situations in which authors, whether students or professionals, find themselves in need of extensive external assistance with their writing can also raise some interesting ethical dilemmas. For example, consider the doctoral candidate who, because of limited writing skills, relies heavily on an individual or editorial service resulting in that individual making

substantial editorial changes to the writing of the thesis. Such a situation may be acceptable as long as the named author indicates in a byline or acknowledgement section the full extent of others' assistance. This, however, is not always done and one of the reasons is that such acknowledgement may reflect negatively on the author as possibly indicating that s/he does not have the necessary skills expected of a doctoral candidate. By mischaracterizing or by not acknowledging altogether the high level of assistance received, students falsely portray a level of academic competency that they truly lack. In instances in which doctoral students anticipate relying on outside individuals to help with the writing of a thesis or even term paper, it is strongly recommended that they confer with their thesis committee and supervisor to determine the accepted parameters of such assistance and to fully disclose the nature of the assistance received.

Professional Ghost Authorship

In the literary world ghost authorship is most often associated with celebrity-authored works in which a celebrity, together with a skilled writer produce written products, such as an autobiography or a sort of "tell all" book. Although much of the writing may be done by the ghost writer, his/her contributions are not always acknowledged and, consequently, in those instances the reader may be mislead into believing that the celebrity is the sole author of the work.

In the biomedical sciences ghost writing has become particularly problematic (see Ngai, Gold, Gill, & Rochon, 2005). For example, in a typical scenario, a pharmaceutical or medical device company will hire an outside researcher with known expertise in the company's line of products (e.g., antidepressants) to write an "balanced " review of their product. To facilitate the write-up of the paper, the company furnishes the expert with a draft of the paper that had already been prepared by a ghost author employed by the company. And, as it often happens in these types of cases, the resulting paper ends up portraying the product in a more favorable light than in reality it might deserve.

The extent of ghost contributions can range from the initial draft framing of a manuscript to the complete or nearly complete write-up of the paper (see the distinction made by Chalmers as cited by Altus, 2006). In either case, the main concern is the extent to which the writing influences the reader toward a particular product or point of view rather than presenting an unbiased position or data. In the past few years, several articles and editorials have condemned the practice as ethically questionable. For example, the World Association of Medical Editors has produced a position statement, which considers ghost authorship dishonest and unacceptable.

GUIDELINE 26: Academic or professional ghost authorship in the sciences is ethically unacceptable.

Sources on publication and authorship from which the above guidelines were derived

- Committee on Publication Ethics (COPE) Guidelines On Good Publication Practice
- International Committee of Medical Journal Editors, Uniform Requirements for Manuscripts Submitted to Biomedical Journals
- British Sociological Association: Authorship Guidelines for Academic Papers
- For additional references on authorship consult The Council of Science Editors

A brief overview on Conflict of Interests

When an investigator's relationship to an organization affects, or gives the appearance of affecting, his/her objectivity in the conduct of scholarly or scientific research, a conflict of interest is said to occur. The relationship does not have to be a personal nor a financial one. For example, a conflict of interest could arise when a family member of a researcher is associated with an organization whose product the researcher is in the process of evaluating. Does the family member's association with the organization compromise his ability to carry out the evaluation objectively? Perhaps. Let's consider another example, imagine an investigator who has been conducting basic science on the various processes involved in the release of certain neurotransmitters and whose work has been steadily funded by the maker of one of the most popular antidepressants. Now imagine a new situation where the research carried out by that investigator naturally leads him to study the efficacy of that same antidepressant while being funded by the company that manufactures it. In conducting the research, is that investigator's objectivity affected by his long-standing relationship to the drug company? Perhaps it hasn't.

Naturally, some conflicts of interest are unavoidable and having a conflict of interest is not in itself unethical. However, the increasing role industry has played in sponsoring research that bears on commercial applications has led to a focus on how such sponsorship affects the research process and outcomes. The situation appears to be particularly serious in the realm of pharmaceutical research. For example, Stelfox, Chua, O'Rourke, and Detsky (1998) collected a sample of published reports (e.g., studies, letters to the editor) on the safety of calcium channel blockers, drugs used to treat cardiovascular disease and correlated the authors' conclusions about their efficacy with whether or not the investigators had received financial support from companies that manufacture those types of drugs. The results revealed a strong association between conclusions that were supportive of the drugs and prior financial support from companies that were associated with those types of drugs.

To ameliorate the situation, research institutions, professional societies, and an increasing number of journals have formulated guidelines for dealing with potential conflicts of interest. Essentially, most of these guidelines require authors to disclose such conflicts either in the cover letter to the editor of the journal to which an investigator submits a manuscript and/or in a footnote on the manuscript itself. For additional details consult the various statements listed in the ORI web site (see next section).

GUIDELINE 27: Authors must become aware of possible conflicts of interest in their own research and to make every effort to disclose those situations (e.g., stock ownership, consulting agreements to the sponsoring organization) that may pose actual or potential conflicts of interest.

Links to resources on Conflicts of Interest listed by ORI

On Being A Scientist: Responsible Conduct in Research
Draft Interim Guidance on Financial Relationships in Clinical Research: DHHS
Report on Individual Financial Interest in Human Subjects Research: AAMC
Report on Conflict of Interest in Biomedical Research: GAO
Conflict of Interest Statement - NIH

Complete list of Guidelines

1. An ethical writer ALWAYS acknowledges the contributions of others and the source of his/her ideas.

2. Any verbatim text taken from another author must be enclosed in quotation marks.

3. We must always acknowledge every source that we use in our writing; whether we paraphrase it, summarize it, or enclose it quotations.

4. When we summarize, we condense, in our own words, a substantial amount of material into a short paragraph or perhaps even into a sentence.

5. Whether we are paraphrasing or summarizing we must always identify the source of our information.

6. When paraphrasing and/or summarizing others' work we must reproduce the exact meaning of the other author's ideas or facts using our words and sentence structure.

7. In order to make substantial modifications to the original text that result in a proper paraphrase, the author must have a thorough understanding of the ideas and terminology being used.

8. A responsible writer has an ethical responsibility to readers, and to the author/s from whom s/he is borrowing, to respect others' ideas and words, to credit those from whom we borrow, and whenever possible, to use one's own words when paraphrasing.

9. When in doubt as to whether a concept or fact is common knowledge, provide a citation.

10. Authors who submit a manuscript for publication containing data, reviews, conclusions, etc., that have already been disseminated in some significant manner (e.g., published as an article in another journal, presented at a conference, posted on the internet) must clearly indicate to the editors and readers the nature of the previous dissemination.

11. Authors of complex studies should heed the advice previously put forth by Angell & Relman (1989). If the results of a single complex study are best presented as a 'cohesive' single whole, they should not be partitioned into individual papers. Furthermore, if there is any doubt as to whether a paper submitted for publication represents fragmented data, authors should enclose other papers (published or unpublished) that might be part of the paper under consideration (Kassirer & Angell, 1995)

12. Because some instances of plagiarism, self-plagiarism, and even some writing practices that might otherwise be acceptable (e.g., extensive paraphrasing or quoting of key elements of a book) can constitute copyright infringement, authors are strongly encouraged to become familiar with basic elements of copyright law.

13. While there are some situations where text recycling is an acceptable practice, it may not be so in other situations. Authors are urged to adhere to the spirit of ethical writing and avoid reusing their own previously published text, unless it is done in a manner consistent with standard scholarly conventions (e.g., by using of quotations and proper paraphrasing).

14. Authors are strongly urged to double-check their citations. Specifically, authors should always ensure that each reference notation appearing in the body of the manuscript corresponds to the correct citation listed in the reference section and that each source listed in the reference section has been cited at some point in the manuscript. In addition, authors should also ensure that all elements of a citation (e.g., spelling of authors' names, volume number of journal, pagination) are derived directly from the original paper, rather than from a citation that appears on a secondary source. Finally, authors should ensure that credit is given to those authors who first reported the phenomenon being studied.

15. The references used in a paper should only be those that are directly related to its contents. The intentional inclusion of references of questionable relevance for purposes of

manipulating a journal’s or a paper’s impact factor or a paper’s chances of acceptance is an unacceptable practice.

16. Authors should follow a simple rule: Strive to obtain the actual published paper. When the published paper cannot be obtained, cite the specific version of the material being used, whether it is conference presentation, abstract, or an unpublished manuscript.

17. Generally, when describing others’ work, do not rely on a secondary summary of that work. It is a deceptive practice, reflects poor scholarly standards, and can lead to a flawed description of the work described.

18. If an author must rely on a secondary source (e.g., textbook) to describe the contents of a primary source (e.g., an empirical journal article), s/he should consult writing manuals used in her discipline to follow the proper convention to do so. Above all, always indicate the actual source of the information being reported.

19. When borrowing heavily from a source, authors should always craft their writing in a way that makes clear to readers which ideas are their own and which are derived from the source being consulted.

20. When appropriate, authors have an ethical responsibility to report evidence that runs contrary to their point of view. In addition, evidence that we use in support of our position must be methodologically sound. When citing supporting studies that suffer from methodological, statistical, or other types of shortcomings, such flaws must be pointed out to the reader.

21. Authors have an ethical obligation to report all aspects of the study that may impact the independent replicability of their research.

22. Researchers have an ethical responsibility to report the results of their studies according to their a priori plans. Any post hoc manipulations that may alter the results initially obtained, such as the elimination of outliers or the use of alternative statistical techniques, must be clearly described along with an acceptable rationale for using such techniques.

23. Authorship determination should be discussed prior to commencing a research collaboration and should be based on established guidelines, such as those of the International Committee of Medical Journal Editors.

24. Only those individuals who have made substantive contributions to a project merit authorship in a paper.

25. Faculty-student collaborations should follow the same criteria to establish authorship. Mentors must exercise great care to neither award authorship to students whose contributions do not merit it, nor to deny authorship and due credit to the work of students.

26. Academic or professional ghost authorship in the sciences is ethically unacceptable.

27. Authors must become aware of possible conflicts of interest in their own research and to make every effort to disclose those situations (e.g., stock ownership, consulting agreements to the sponsoring organization) that may pose actual or potential conflicts of interest."

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Paraphrasing/Plagiarism Exercise

Earlier, when we covered paraphrasing and plagiarism, we offered various examples of properly paraphrased and plagiarized text. Because inappropriate paraphrasing appears to be one of the most common forms of plagiarism it is important that contributors to the scientific literature become sensitive to this problem and integrate proper paraphrasing practices in their writing. To that effect, an exercise has been developed for the purpose of offering instruction on acceptable paraphrasing strategies.

For this exercise, the reader is asked to imagine the following scenario: You are working on a manuscript in which you review published studies on the colony raiding behavior of fire ants, *S. invicta*. In one of the journal articles that you are reading for your review there is a short paragraph that you deem very important and thus, you decide that you want to include the information in your manuscript. Here is the paragraph:

> *This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested*

> *whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation.*[1]

.[1]Balas M, Adams ES, 1996.Intraspecific usurpation of incipient fire ant colonies. Behav Ecol 8:99-103.

You could copy the above paragraph verbatim, enclose it in quotation marks, and include it in your manuscript, but as is generally known in the biomedical sciences, the use of quoted text, a fairly common practice in certain disciplines within the humanities, is typically shunned by most authors and editors of biomedical journals. Another option would be for you to summarize the important points of the above paragraph by condensing it into one or two shorter sentences that fully capture the essence of the ideas being conveyed. However, let's assume that your intention is to paraphrase the entire paragraph thereby preserving all of the information contained in the paragraph. How would you paraphrase the paragraph without committing plagiarism and in a manner that is consistent with the principles of ethical writing?

For the first part of this exercise, please paraphrase the above paragraph to the best of your ability. Take your time and use whatever resources you deem necessary (e.g., dictionary, thesaurus). Before commencing, keep in mind that when paraphrasing you must substantially modify the original text while preserving the exact meaning of the ideas conveyed in the original paragraph. You should note that when faced with the task of paraphrasing text, many individuals often complain that the reason their paraphrases are too close to the original is because there are only a limited number of ways that one can express the same thought. Although this may be true to some extent when the original text is comprised of highly technical language, such as the paragraph on mammalian histone lysine methyltransferase used earlier in our discussion of plagiarism, it is not true for most other writing. It is certainly not true for the sample paragraph on fire ants that we have selected.

You should also remember that your paraphrase must also indicate the source of the original material. This is typically done with either a footnote or with some form of parenthetical notation indicating the source of the original. For example, in the style suggested by the American Psychological Association, you might insert the following at the end of your paraphrase: (Balas and Adams, 1996). For this exercise, please assume that your paraphrase contains the proper reference notation indicating the source of the material. You should also assume that a full citation has been placed in the reference section of your paper.

Use the space below to paraphrase the paragraph:

The second part of the exercise will help you to determine whether your rewritten version of the paragraph meets the requirements of an appropriate paraphrase. For this portion of the exercise, you are to place yourself in the same scenario as described above: That you are writing a paper on the ecology and behavior of fire ants and that you discover a paragraph that you wish to paraphrase in your paper.

Below you will find several rewritten versions of the original paragraph. Please examine each version and determine whether it has been properly paraphrased or whether it constitutes an instance of potential plagiarism. As you consider each rewritten version, please assume that you have already incorporated it into your manuscript and that you are now reviewing that section of your paper for accuracy and proper scholarship. Immediately after you select your answer you will be given feedback as to the correctness of your responses.

ORIGINAL PARAGRAPH

> *"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."*

REWRITTEN VERSION 1:

<u>A study was conducted to examine whether workers of *S. invicta* can assist their mothers in colony usurpations. The first hypothesis tested was whether queens of *S. invicta* are better able to usurp colonies to which their daughters have moved. For the second</u>

hypothesis, the researchers tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. The researchers observed aggressive behavior during these usurpation attempts to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation.

Please indicate whether the above paragraph is:

1. Properly paraphrased.
2. Definitely plagiarized.
3. Cannot determine.

FEEDBACK: This rewritten version is definitely plagiarized. The author has merely added or substituted a few words at the beginning of each sentence, and copied verbatim the remainder of the sentences. Notice that although none of the sentences in the rewritten paragraph are identical to their counterparts in the original, the rewritten version is still deemed as an instance of plagiarism because the author has simply appropriated too many phrases from the original. Thus, the attempted paraphrase falls way short of the requirement for the original text to be thoroughly modified. This is a clear-cut case of plagiarism. See the following tables for comparisons between the original paragraph and its rewritten counterpart.

ORIGINAL VERSION	**PLAGIARIZED VERSION**
"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."	A study was conducted to examine whether workers of *S. invicta* can assist their mothers in colony usurpations. The first hypothesis tested was whether queens of *S. invicta* are better able to usurp colonies to which their daughters have moved. For the second hypothesis, the researchers tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. The researchers observed aggressive behavior during these usurpation attempts to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation.

* Red colored, underlined strings of text indicate that they have been taken verbatim from the original paragraph.

* Blue highlighted text indicates that it has been appropriated from the original paragraph with a change in the order of the words or phrases.

ORIGINAL PARAGRAPH

> *"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."*

REWRITTEN VERSION 2

An investigation was carried out to examine whether workers of *S. invicta* can assist their mothers in colony usurpations. The first hypothesis tested was whether queens of *S. invicta* are better able to usurp colonies to which their daughters have moved. The second hypothesis tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressiveness during these usurpation attempts was measured to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation.

Please indicate whether the above paragraph is:

1. Properly paraphrased.
2. Definitely plagiarized.
3. Cannot determine.

FEEDBACK: The author has not truly paraphrased the original paragraph. As with the first rewritten version, only a few words have been substituted, deleted, or added, leaving the rest of the sentences in the new paragraph virtually unchanged. Once again, too many of the phrases that make up the original paragraph are reproduced in the rewritten version. The author has simply failed to modify the original material sufficiently. For these reasons, the current rewritten version is considered an instance of definite plagiarism.

ORIGINAL VERSION

"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."

PLAGIARIZED VERSION

An investigation was carried out to examine whether workers of *S. invicta* can assist their mothers in colony usurpations. The first hypothesis tested was whether queens of *S. invicta* are better able to usurp colonies to which their daughters have moved. The second hypothesis tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressiveness during these usurpation attempts was mesured to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting ussurpation

* Red colored, underlined strings of text indicate that they have been taken verbatim from the original paragraph.

* Blue highlighted text indicates that it has been appropriated from the original paragraph with a change in the order of the words or phrases.

ORIGINAL PARAGRAPH

"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."

REWRITTEN VERSION 3

To determine whether workers of *S. invicta* can assist their mothers in colony usurpations, two researchers have conducted a study in which the following hypotheses were tested: First, they wanted to see whether queens of *S. invicta* are better able to usurp colonies to which their daughters have moved. Second, they tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. The ants' aggressive behavior during these usurpation attempts was observed to determine if the presence of related or familiar workers influenced the aggressive response toward either the resident queen or the queen attempting a colony take-over.

Please indicate whether the above paragraph is:

1. Properly paraphrased.
2. Definitely plagiarized.
3. Cannot determine.

FEEDBACK: The first sentence of the rewritten version is probably an acceptable paraphrase of the first sentence in the original paragraph. However, with the exception of a minor transposition of words in the last sentence, the rest of the sentences have only been superficially changed by the addition or substitution of a few words at the beginning of each sentence. The remaining phrases in these sentences have not changed. As with the previous example, none of the sentences in the rewritten paragraph are totally identical to their counterparts in the original. Because there is still a significant amount of verbatim material taken from the original, the rewritten version would still be deemed as an example of plagiarism.

ORIGINAL VERSION	PLAGIARIZED VERSION
"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."	To determine whether workers of *S. invicta* can assist their mothers in colony usurpations, two researchers have conducted a study in which the following hypotheses were tested: First, they wanted to see whether queens of *S. invicta* are better able to usurp colonies to which their daughters have moved. Second, they tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. The ants' aggressive behavior during these usurpation attempts was observed to determine if the presence of related or familiar workers influenced the aggressive response toward either the resident queen or the queen attempting a colony take-over.

* Red colored, underlined strings of text indicate that they have been taken verbatim from the original paragraph.

* Blue highlighted text indicates that it has been appropriated from the original paragraph with a change in the order of the words or phrases.

ORIGINAL PARAGRAPH

> *"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."*

REWRITTEN VERSION 4

To determine whether workers of *S. invicta* can assist their mothers in colony usurpations, a study was conducted in which the following variables were investigated: First, *S. invicta* queens' hypothesized ability to usurp colonies to which their daughters have moved was examined. The second hypothesis tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. During these usurpation attempts aggressive behavior was observed to determine if the presence of familiar or related workers influenced aggression toward either the resident queen or the queen attempting colony usurpation.

Please indicate whether the above paragraph is:

1. Properly paraphrased.
2. Definitely plagiarized.
3. Cannot determine.

FEEDBACK: In this version the first two paraphrased sentences appear to have undergone moderate modifications. However, the second two sentences have not been adequately paraphrased. As with previous versions, the third sentence was changed by a mere substitution of the first two of three words and the fourth sentence has not been changed at all making these two sentences plagiarized versions of the original. Because the first two sentences were not sufficiently modified and because the last two sentences contain only minimal changes, this rewritten version of the original paragraph is still considered as a case of plagiarism.

ORIGINAL VERSION	**PLAGIARIZED VERSION**
"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."	To determine whether workers of *S. invicta* can assist their mothers in colony usurpations, a study was conducted in which the following variables were investigated: First, *S. invicta* queens' hypothesized ability to usurp colonies to which their daughters have moved was examined. The second hypothesis tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. During these usurpation attempts aggressive behavior was observed to determine if the presence of familiar or related workers influenced aggression toward either the resident queen or the queen attempting colony usurpation.

* Red colored, underlined strings of text indicate that they have been taken verbatim from the original paragraph.

* Blue highlighted text indicates that it has been appropriated from the original paragraph with a change in the order of the words or phrases.

ORIGINAL PARAGRAPH

> *"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."*

REWRITTEN VERSION 5

An investigation was carried out to determine whether S. invicta mothers are helped by their worker offspring during colony usurpations. The study's focus of investigation was the question of whether colony take-over by S. invicta queens is more effective when their daughters first invade the colonies. One hypothesis concerned the extent to which daughters' familiarity with the queen, or their genetic similarity to her, affects successful colony take-over. During attempts at taking over another colony, behavioral observations were made of usurping workers that were either familiar or genetically related to the queens to see if these variables were related to aggressive behavior toward the resident or the invading queen.

Please indicate whether the above paragraph is:

1. Properly paraphrased.
2. Definitely plagiarized.
3. Cannot determine.

FEEDBACK: Although some of the terms from the original paragraph have been retained in the rewritten version, the current paraphrased version has been sufficiently modified from the original and is, therefore, classified as having been correctly paraphrased.

ORIGINAL VERSION	PLAGIARIZED VERSION
"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."	An investigation was carried out to determine whether S. invicta mothers are helped by their worker offspring during colony usurpations. The study's focus of investigation was the question of whether colony take-over by S. invicta queens is more effective when their daughters first invade the colonies. One hypothesis concerned the extent to which daughters' familiarity with the queen, or their genetic similarity to her, affects successful colony take-over. During attempts at taking over another colony, behavioral observations were made of usurping workers that were either familiar or genetically related to the queens to see if these variables were related to aggressive behavior toward the resident or the invading queen.

* Red colored, underlined strings of text indicate that they have been taken verbatim from the original paragraph.

* Blue highlighted text indicates that it has been appropriated from the original paragraph with a change in the order of the words or phrases.

ORIGINAL PARAGRAPH

> *"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."*

REWRITTEN VERSION 6

Balas and Adams carried out an investigation to determine whether S. invicta mothers are helped by their worker offspring during colony take-overs. These authors asked whether colony take-over by S. invicta queens is more effective when their daughters first invade the colonies. A second hypothesis concerned the extent to which daughters' familiarity with the queen, or their genetic similarity to her, affects successful colony take-over. During these occupation attempts, aggressive behavior of usurping workers that were either familiar or genetically related was observed to see if these variables mediated aggressive behavior toward the invading or the resident queen.

Please indicate whether the above paragraph is:

1. Properly paraphrased.
2. Definitely plagiarized.
3. Cannot determine.

FEEDBACK: If you selected "properly paraphrased", you are correct. Although as in the earlier example (No. 5) the structure of the paragraph (i.e., order of the sentences) has been preserved, the present rewritten paragraph represents a thoroughly modified version of the original. The reader is reminded, however, that in some disciplines, particularly within the humanities, a proper paraphrase entails a change in the overall structure of the paragraph as well as a change in the wording. Given, that scientific writing is sometimes multidisciplinary in scope, authors should make every effort to be thoroughly acquainted with the rules of scholarship encompassing the readership of their work.

ORIGINAL VERSION	PLAGIARIZED VERSION
"This study examines whether workers of S. invicta are able to assist their mothers in colony usurpations. First we tested whether [queens] of S. invicta are better able to usurp colonies to which their daughters have moved. Second, we tested whether the effect of daughters on usurpation success is due to familiarity with the queen or to genetic relatedness. Aggressive behavior during these usurpation attempts was observed to determine if the presence of familiar or related workers influenced the aggressive response toward either the resident queen or the queen attempting usurpation."	Balas and Adams carried out an investigation to determine whether S. invicta mothers are helped by their worker offspring during colony take-overs. These authors asked whether colony take-over by S. invicta queens is more effective when their daughters first invade the colonies. A second hypothesis concerned the extent to which daughters' familiarity with the queen, or their genetic similarity to her, affects successful colony take-over. During these occupation attempts, aggressive behavior of usurping workers that were either familiar or genetically related was observed to see if these variables mediated aggressive behavior toward the invading or the resident queen.

* Red colored, underlined strings of text indicate that they have been taken verbatim from the original paragraph.

* Blue highlighted text indicates that it has been appropriated from the original paragraph with a change in the order of the words or phrases.